Section 25 Aggregate Subbases

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4-2501 General

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Aggregate subbase is designated by class. The *Standard Specifications* describe the requirements for each class, and the contract will specify the class of aggregate subbase to be used.

Aggregate subbase is normally the lowest layer in the structural section, as the contract plans show in their typical cross sections. The typical cross sections also show the thickness of aggregate subbase. The plan layout sheets will show where aggregate subbase is to be placed.

Aggregate subbase may be measured by volume or by mass. The engineer's estimate will show the unit of measurement for aggregate subbase.

4-2502 Before Work Begins

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Before placement begins, review the contract plans and specifications to determine the requirements for aggregate subbase. For the requirements for sampling and testing aggregate base, including frequency of testing, see Chapter 6, "Sampling and Testing," of the *Construction Manual* (manual).

The engineer should also include in the preliminary review and inspections the following steps:

- Verify the Design R-value by testing the basement material at the grading plane to ensure adequate thickness of the structural section. Testing should be completed early enough before the placement of aggregate subbase to allow time for redesign if necessary. (See Topic 604 in the *Highway Design Manual* for a discussion of R-Value and structural section design.) Any necessary adjustments in thickness are usually made in the subbase.
- Test potential sources of aggregate subbase when the contractor requests such testing in writing. When Section 6-2.01, "General," of the *Standard Specifications* requires charging the contractor for initial samples and tests, deduct any applicable charges from contract payments.
- If reclaimed material is being used for the aggregate subbase, ensure the percentage of reclaimed material complies with contract requirements.
- Review compaction tests of the basement material at the grading plane that is to receive aggregate subbase. Ensure the basement material is still firm and stable. Give special attention to isolated areas where pumping occurs.
- Measure the grading plane for compliance with Section 19-1.03, "Grade Tolerance," of the *Standard Specifications*. When measuring for compliance, spot-check areas between stations where stakes are set, as well as the staked locations. District personnel will determine the extent of this measurement, based on various factors such as the nature of material, the efficiency of the contractor's

operation, and the accuracy of the grading operation (as indicated during the early stages of checking). Section 19-1.03 specifies tolerances above or below the grade established by the engineer. This grade will be one resulting from the control stakes placed by Caltrans forces.

- If the contractor proposes to change the method of measurement from mass to volume, in accordance with Section 25-1.03, "Subgrade," of the *Standard Specifications*, to eliminate subgrade preparation, do the following:

  1. Test the material immediately below the grading plane to determine whether it meets all the specifications for aggregate subbase. District personnel will determine the number of such tests depending on the uniformity of the material. The contractor may choose to just leave the subgrade low and fill the low area with the imported aggregate subbase. Ensure the contractor complies with Section 19-5.03, "Relative Compaction (95 Percent)," and Section 25-1.05, "Compacting," of the *Standard Specifications*.
  2. Ensure no material projects above the grade established by the engineer.
  3. For payment, prepare a contract change order (requested by the contractor) establishing a factor to convert volume to mass. Obtain the contractor's agreement before proceeding.

- Give the contractor written permission if you decide that, to stabilize a cohesionless subgrade, the aggregate subbase may be dumped in piles and spread ahead.
- Determine whether the contractor has complied with all requirements related to the use of local materials. (See Section 6-2, "Local Materials," of the *Standard Specifications* for details.)

4-2503 During the Course of Work

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During work operations, the engineer should do the following:

- Sample the aggregate subbase at the time it is deposited on the roadbed. For all requirements related to quality, perform the tests at the frequencies shown in Section 6-1, "Sampling Types and Frequencies," of this manual. The frequency table does have a provision for waiving the testing for R-value, but exercise judgement when doing so. Previous tests must be current. For small amounts (under 500 tonnes), data from other projects or information from your district's laboratory is normally sufficient. On larger projects, consider using at least one potential source or acceptance test as well as past experience on which to base your decision. Include in the project records an explanation of why you waived R-value testing.
- The contractor is not allowed to process material on the roadbed to make it comply with grading specifications. Therefore, before aggregate subbase is deposited on the roadbed, ensure the removal of oversized material and also do any necessary blending.
- Compare sand equivalent and grading test results with requirements for operating range and contract compliance. (See Section 3-608A, "Operating Range and Contract Compliance," of this manual.) Note that the volume of aggregate subbase that may be represented by one test for contract compliance is much less than

that required for testing frequency. It is prudent to take frequent samples, especially with borderline test results, but only test on the frequency shown in the table in Section 6-1 of this manual. If a test result fails to meet the requirement for contract compliance, you may test additional samples, previously taken, to determine the quantity of material represented by the failing test result.

- When aggregate subbase is to be paid for by the tonne, take sufficient moisture samples at the time of weighing to accurately determine pay quantities.
- Ensure aggregate subbase is being spread on the subgrade without significant segregation. Normally, you would perform this step through observation, but if problems persist, support your observations with a sieve analysis. If segregation is taking place, sometimes it can be avoided by wetting the material before it is hauled to the job or before spreading operations start. Watering and compacting go hand in hand. It is important that the proper amount of water is evenly distributed in the aggregate at the time of compaction.
- Observe the spreading and compacting operation to ensure it conforms to the layer thickness requirements of the specifications. Note in the daily report any wasting of material.
- If payment is by the tonne, measure waste, and deduct such quantities. Advise the contractor immediately when you are considering such deductions. However, some material may be lost during any trimming, and district personnel will decide when such trimmings should be measured. In general, measure trimmings when the cost of such measurement does not exceed the anticipated deduction.
- Test the compaction of aggregate subbase layers. The testing frequencies shown in Section 6-1 of this manual indicate testing will be "as necessary for acceptance." The decision on how much testing is necessary will be based on the material's uniformity and the particular operation. Generally, if the operation is uniform and well within specifications, you may decrease testing frequencies. For nonuniform operations with borderline results, increase testing frequency.
- For Class 1, 2, and 3 aggregate subbase, observe the compacting operation to ensure the material forms a firm, stable base.
- Measure the surface of the finished aggregate subbase for conformance with tolerances specified in Section 25-1.05, "Compacting," of the *Standard Specifications*. Control stakes set by state forces determine the planned elevation of the subbase surface. Require corrective action for any deficiencies.
- Measure the thickness of the completed aggregate subbase. Use your judgement to determine the number of measurements necessary. The minimum acceptable thickness of aggregate subbase equals the planned thickness less the specified tolerances for high basement material and low surface of aggregate subbase. A thin section is acceptable if the deficiency is made up by additional thickness in a base material above the aggregate subbase. The *Standard Specifications* allow the engineer to accept a deduction for deficient thickness in lieu of other corrective action. However, Caltrans policy is to ensure thickness complies with requirements by ordering corrective action if thickness is deficient. Therefore, in only the most extenuating circumstances should you apply the deduction.
- Keep adequate records for payments on progress pay estimates and on final estimates. The type and frequency of measurement will depend on the measurement and payment clauses of the contract.

- Note in the daily report any inspections performed on items that are not otherwise part of a permanent record. For instance, you do not need to note any compaction tests taken because these are recorded elsewhere. However, you do need to explain in the daily report any absence of testing. You also need to note that construction is being performed in accordance with specified layer thicknesses because this information is not recorded elsewhere.

4-2504 Measurement and Payment

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When aggregate subbase is paid for by the tonne, see the discussion of weighing and measuring procedures in Section 3-9, "Measurement and Payment," of this manual.

When aggregate subbase is to be measured and paid for by the cubic meter, begin making quantity calculations as early in the project as possible. Obtain quantity calculations from Project Development to determine if they are sufficiently detailed and accurate to be used in the project records.